Experimenting a permanent geoelectrical monitoring system for stability assessment of levees

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Levees are the last defence for human lives and properties against threatening river floods. Unfortunately, no objective procedure to assess the stability of the embankments is currently defined in Italy and only visual inspections are mandatory according to the current law.

The aim of this work is to assess the stability of earthen levees in real time and in an indirect, cost effective and reliable way, thanks to permanent geoelectrical monitoring. A prototypal resistivity meter was designed and installed on an embankment of an irrigation canal near Mantova (northern Italy) in order to control soil saturation and seepage through the levee.

The device is designed to be installed permanently: it is powered by a solar panel and it works remotely, sending data through internet connection to a web database. In the same site a meteorological station was installed to correlate external variables, such as water level, temperature and rainfall, to the measured data. Data from two years of operation have been collected and analysed so far. The long-period seasonal variations of resistivity within the levee body associated with the level of water in the irrigation canal have been characterized.

Rainfalls and temperature variations also affect the resistivity maps and the data from the meteorological station are used to consider these effects.

In order to monitor soil water content, an empirical and site dependent function that links inverted resistivity values to water content levels was developed using the data obtained from core samples (Figure). Applying this calibration function, water content maps can be used to implement the analysis of seepage and stability risks and to activate alarms when fixed thresholds are overcome.

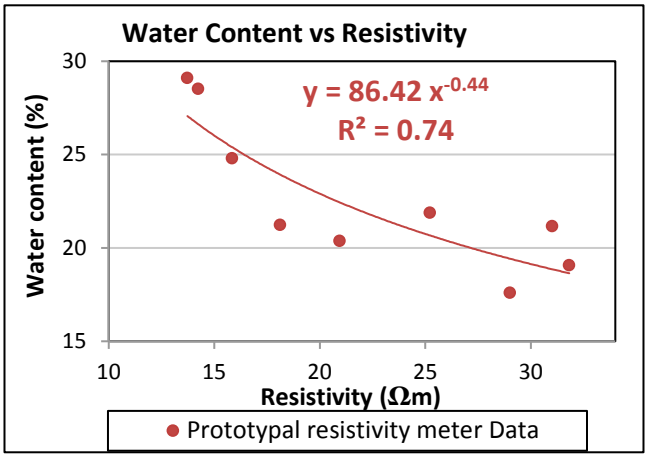

Figure: Water content vs resistivity relationship.

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